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NAVAL DENTAL RESEARCH INST GREAT LAKES IL
SUMMARIES OF RESEARCH, FISCAL YEAR 1980. (U)
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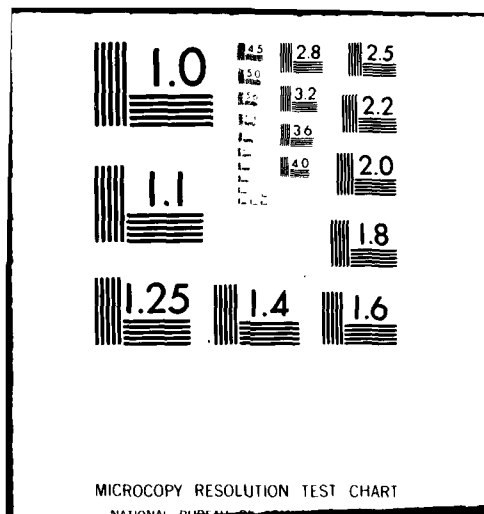
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SUMMARIES OF RESEARCH

FISCAL YEAR 1980

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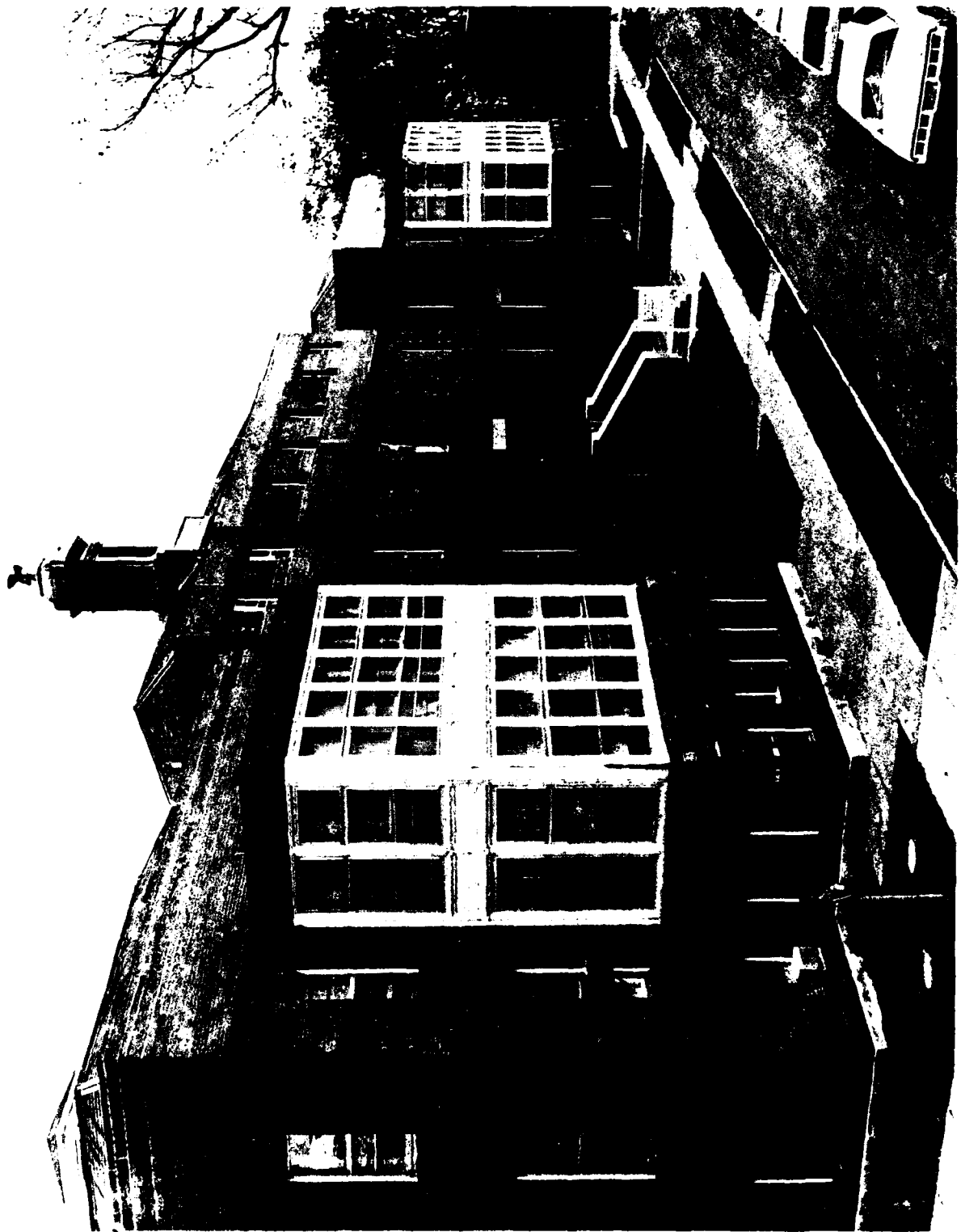
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DENTAL RESEARCH
INSTITUTE

Naval Medical Research and Development Command
Bethesda, Maryland

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NAVAL DENTAL RESEARCH INSTITUTE
NAVAL BASE, BLDG. 1-H
GREAT LAKES, ILLINOIS 60088

SUMMARIES OF RESEARCH
Fiscal Year 1980

These summaries cover research carried out from 01 October 1979 through 30 September 1980.

This document has been approved for public release; its distribution is unlimited.

Approved and released by:

M. R. Wirthlin, Jr.

M. R. WIRTHLIN, JR.
Captain, DC, USN
Commanding Officer

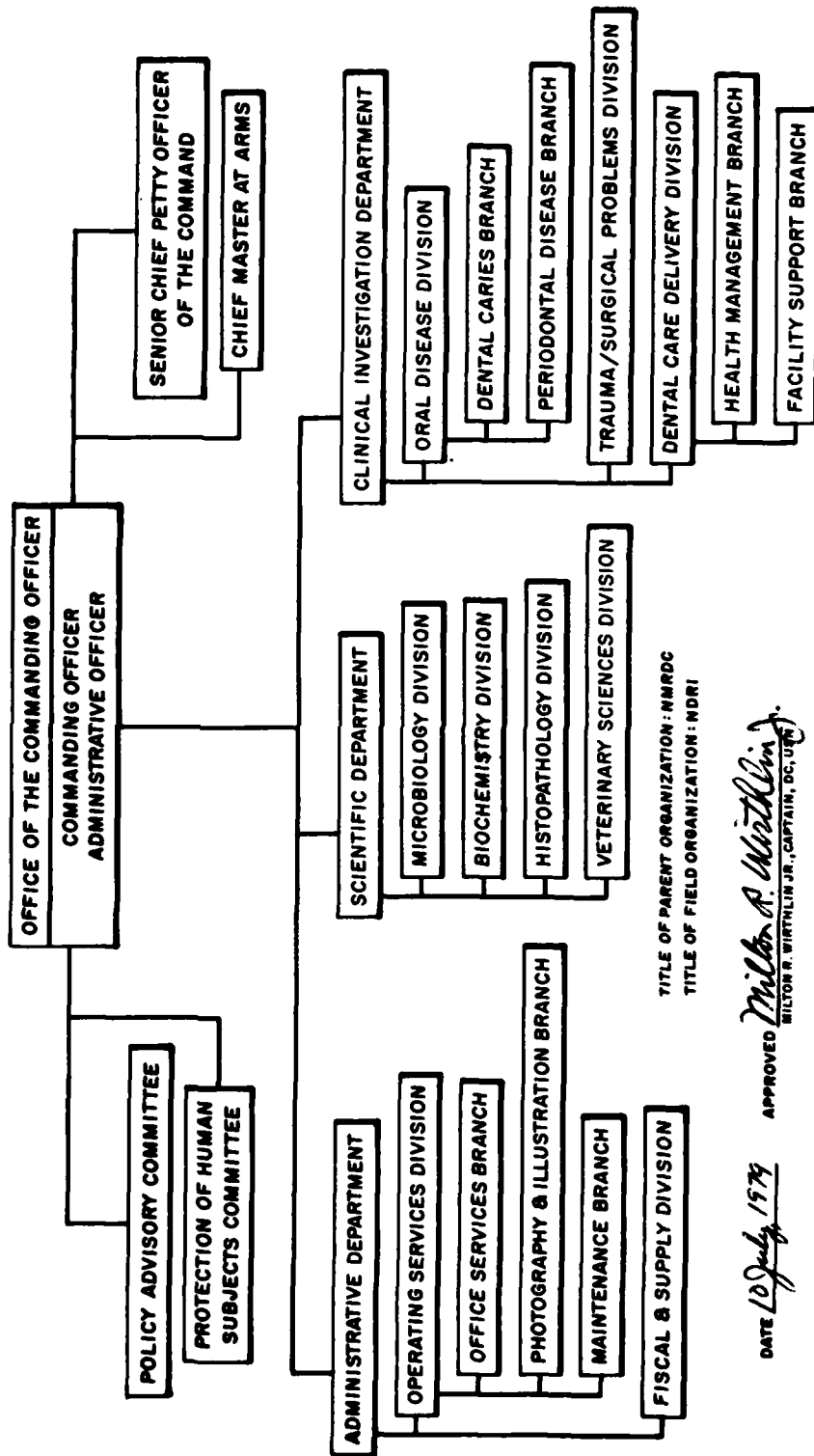
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NOTE 1. Comptroller and Military Personnel Record support performed by Naval Regional Medical Center, Great Lakes. Civilian Personnel Record Support performed by CCPO, Great Lakes.

NAVAL DENTAL RESEARCH INSTITUTE



TITLE OF PARENT ORGANIZATION: NMDC
TITLE OF FIELD ORGANIZATION: NDRI

DATE 10 July 1979 APPROVED *Milton R. Wirthlin Jr.*
MILTON R. WIRTHLIN JR., CAPTAIN, DC, USN

MISSION

COMMAND

The Naval Dental Research Institute was officially established 01 January 1967. The command was developed from the Dental Research Facility, which was a Division of the Dental Department of the Naval Administrative Command, Naval Training Center, Great Lakes.

MISSION

The mission of the Institute is to conduct research, development, test and evaluation in dental and allied sciences, with particular emphasis on problems of dental and oral health in Navy and Marine Corps populations and on problems of fleet and field dentistry.

PERSONNEL

As of 30 September 1980, there were on board 15 commissioned officers, 14 civilian employees, and 16 enlisted members, including assigned Air Force members.

ORGANIZATION

The Institute has undergone some reorganization since 1967. The current organization of three major Departments is reflected on the preceeding page. The Scientific Department consists of the Microbiology, Biochemistry, Histopathology, and Veterinary Sciences Divisions. Respectively, they carry out required microbiological, serological and bacteriological analysis; biochemical studies of etiological agents and of host factors involved in oral diseases; assistance, advice and preparation of specimens for histological analysis; and research in the field of laboratory animal medicine and dentistry. The Clinical Investigation Department conducts research related to prevention and treatment of dental and oral diseases with primary emphasis directed toward acute and chronic infections, problems of dento-alveolar trauma and injury, and the delivery of optimal dental care for the naval population. The Administrative Department provides the Institute with supply and fiscal services; library, general clerical services and manuscript preparation; photography and graphics; and equipment and facility maintenance, as well as special fabrications and instrumentation support.

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES
RESULTS REPORTED AND/OR DISCUSSIONS LED

OCTOBER

WIRTHLIN, M. R. and CECIL, J. C. presented "Managing Oral and Dental Health by Surveillance and Prevention of Disease" at the AMSUS meeting, San Diego, CA.

WIRTHLIN, M. R. presented "Clinical and Laboratory Studies for the Prevention of Dental and Oral Diseases," at Sigma Xi, Abbott Laboratories, North Chicago, IL.

NOVEMBER

CECIL, J. C. presented "Epidemiology of Dental Diseases and Dental Research in the Navy," at the Preventive Dentistry and Patient Motivation Continuing Education Course, National Naval Dental Center, Bethesda, MD.

CECIL, J. C. presented "Dental Public Health Programs," at the National Naval Dental Center, Bethesda, MD.

DECEMBER

CLARK, G. E. presented "Aspects of Dental Caries," to members of the Science Club, North Chicago High School.

JANUARY

GAUGLER, R. W. presented "Fluoride Concentration of Dental Plaque of Caries-Free and Caries-Active Naval Recruits," at Loyola University, School of Medicine, Department of Microbiology, Chicago, IL.

HANCOCK, E. B. presented "Review of Graduate Research in Periodontics," at Indiana University, School of Dentistry, Indianapolis, Indiana.

MARCH

The 58th General Session of the American Association for Dental Research meeting held in Los Angeles, California was attended by the following staff personnel:

ANDERSON, D. M. presented "Criteria for the Assessment of Dental Pulp Health Beneath Deep Caries."

CECIL, J. C. presented "Incidence of Dental Caries After Six Months Among a Sample of Naval Recruits."

**FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)**

MARCH (Continued)

- GAUGLER, R. W. presented "Fluoride Concentration in Plaque of Caries-Free and Caries-Active Naval Recruits."
- HANCOCK, E. B. presented "Histologic Assessment of Probing in the Presence of Periodontitis."
- LAMBERTS, B. L. presented "Salivary pH-Rise Profiles of Oral Organisms in Relation to Caries Experience."
- LEONARD, E. P. presented "The Potential Hazard of Burning Out Dental Casting Wax."
- LEONE, S. A. presented "An Evaluation of Porosity of Aluminum Oxide."
- MUELLER, E. J. presented "Inhibition of Treponema oralis by Surface Active Compounds."
- SHKLAIR, I. L. presented "Glucan Synthesis of S. mutans from Caries-Active and Caries-Free Naval Recruits."
- WIRTHLIN, M. R. presented "The Performance of Autoclaved High-Speed Dental Handpieces."

APRIL

- SHKLAIR, I. L. presented "Natural Occurrence of Caries in Animals - Animals as Vectors and Reservoirs of Cariogenic Flora" at the Symposium and Workshop on Animal Models in Cariology at Sturbridge, MA.
- LEONARD, E. P. made a trip to NAMRU-3, Cairo, Egypt. Discussions held with Egyptian Army and Health officials.

JUNE

- The 58th General Session of the International Association for Dental Research meeting held in Osaka, Japan was attended by the following staff personnel:
- CLARK, G. E. presented "The Effect of Carious Dentin Vascular Permeability Factor on the Dental Pulp."
- SIMONSON, L. G. presented "Isolation and Characterization of a New Bacterial α -1, 3-Glucanase from Pseudomonas sp."
- WALTER, R. G. presented "Prevention of Tooth Destruction by a Low Molecular Weight Dextran."

FORMAL PRESENTATIONS OF RESEARCH MADE AT MEETINGS OF SCIENTIFIC SOCIETIES
RESULTS REPORTED AND/OR DISCUSSIONS LED (Continued)

JUNE (Continued)

The following staff personnel presented Table Clinics at the Great Lakes Dental Society:

AKER, F. and SEROWSKI, A. presented "Portable Dental Equipment."

ANDERSON, D. M. presented "The Evaluation of Dental Pulp Health Beneath Deep Caries."

CECIL, J. C. presented "Incidence of Dental Caries within the First Six Months Among Naval Recruits."

CLARK, G. E. presented "The Effect of Carious Dentin Vascular Permeability Factor on the Dental Pulp."

COOPER, J. R. presented "Studies on the Potential Hazard of Dental Casting Wax Burn-Out."

ESQUIRE, R. G. presented "The Treatment of U-Lesions in the Great Lakes Naval Recruit Population."

LEONE, S. A. presented "Studies of Acute Pericoronitis."

MEIERS, J. C. presented "The Bacterial Flora of Incipient Occlusal Lesions in Naval Recruits."

SHKLAIR, I. L. presented "Relationship of Glucan Formation by S. mutans and Dental Caries Activity."

WALTER, R. G. presented "Streptococcus mutans in Caries-Free and Caries-Active Naval Recruits."

JULY

WIRTHLIN, M. R. presented a briefing to the Dental Division, Bureau of Medicine and Surgery on interim progress of the Marine Corps Expeditionary Dental Shelter.

PARTICIPATION IN OTHER PROGRAMS

OCTOBER

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following staff personnel:

CLARK, G. E.
GAUGLER, R. W.
LAMBERTS, B. L.
WIRTHLIN, M. R.

The American Academy of Periodontology Annual Meeting in Seattle, Washington was attended by:

HANCOCK, E. B.
LEONE, S. A.
WIRTHLIN, M. R.

MEIERS, J. C. attended the Third Annual Foods Conference held at the American Dental Association, Chicago, Illinois.

American Dental Association 120th Annual Session in Dallas, Texas was attended by:

AKER, F.
CECIL, J. C.

CECIL, J. C. attended the American Association of Public Health Dentistry 42nd Annual Meeting, Dallas, Texas.

SHKLAIR, I. L. attended the fall meeting of the Illinois Society for Microbiology.

NOVEMBER

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following staff personnel:

AKER, F.	LAMBERTS, B. L.
ANDERSON, D. M.	LEONE, S. A.
CLARK, G. E.	SHKLAIR, I. L.
GAUGLER, R. W.	WALTER, R. G.
HANCOCK, E. B.	WIRTHLIN, M. R.

ANDERSON, D. M. attended the annual seminar of the Edgar D. Coolidge Endodontic Study Club, Chicago, Illinois.

A Conference on Removal of the Third Molars at the National Institute of Dental Research, NIH, Bethesda, Maryland was attended by:

LEONE, S. A.
WIRTHLIN, M. R.

PARTICIPATION IN OTHER PROGRAMS (Continued)

DECEMBER

WIRTHLIN, M. R. was a consultant/participant to Extramural Programs at the National Institute of Dental Research on clinical study of dental implants, Bethesda, MD.

JANUARY

A meeting of the Chicago Section of the American Association for Dental Research was attended by the following staff personnel:

ANDERSON, D. M.
CECIL, J. C.
CLARK, G. E.
LEONARD, E. P.

FEBRUARY

A Navy Reserve luncheon in conjunction with the Mid-winter Chicago Dental Society Meeting was attended by the following staff personnel:

AKER, F.	LEONARD, E. P.
CECIL, J. C.	LEONE, S. A.
CLARK, G. E.	MEIERS, J. C.
HANCOCK, E. B.	WALTER, R. G.
	WIRTHLIN, M. R.

The Midwest Society of Periodontology annual meeting in Chicago, Illinois was attended by:

HANCOCK, E. B.
WIRTHLIN, M. R.

SHKLAIR, I. L. attended a meeting of the Plaque Resource Committee Group of the American Dental Association Health Foundation, Chicago, IL.

MARCH

ANDERSON, D. M. attended a meeting of the Edgar D. Coolidge Endodontic Study Club, Chicago, Illinois.

AKER, F. attended the Kentucky Dental Association convention in Louisville, Kentucky.

HANCOCK, E. B. attended the Executive Medicine Seminar, NHSC, Bethesda, Maryland.

REESE, W. V. attended COI Instructor training at Service School Command, Great Lakes, Illinois.

PARTICIPATION IN OTHER PROGRAMS (Continued)

APRIL

A meeting of the Chicago Section of the American Association for Dental Research was attended by:

GAUGLER, R. W.
LEONARD, E. P.
LEONE, S. A.
WIRTHLIN, M. R.

MEIERS, J. C. attended the Casualty Care Course at Great Lakes, Illinois.

MAY

NDRI hosted an Open House and the Chicago Section of the American Association for Dental Research for their monthly dinner meeting with speaker. Dr. Tung H. Jeong, Sciences Department, Lake Forest College, spoke on "Lasers and Holography." The following personnel attended:

AKER, F.	MEIERS, J. C.
ANDERSON, D. M.	SHKLAIR, I. L.
CECIL, J. C.	SIMONSON, L. G.
CLARK, G. E.	WALTER, R. G.
LAMBERTS, B. L.	WIRTHLIN, M. R.
LEONARD, E. P.	

ANDERSON, D. M. attended the Edgar D. Coolidge Endodontic Study Club, Chicago, Illinois.

A course on Casualty Care presented by the Naval Regional Dental Center, Great Lakes, IL was attended by:

AKER, F.
CECIL, J. C.
LEONE, S. A.
WALTER, R. G.

SHKLAIR, I. L. attended the American Society for Microbiology meeting in Miami, Florida.

JUNE

The Great Lakes Dental Society meeting was attended by the following personnel:

LEONARD, E. P.
MEIERS, J. C.
WIRTHLIN, M. R.

SHKLAIR, I. L. attended the Animal Resources Group Study section of the American Dental Association in Chicago, Illinois.

PARTICIPATION IN OTHER PROGRAMS (Continued)

JULY

COOPER, J. R. attended the annual meeting of the American Veterinary Medical Association in Washington, D. C.

SEPTEMBER

SCHROEDER, D. C. attended the American Association of Oral and Maxillofacial Surgeons meeting in San Francisco, CA.

The Great Lakes Dental Society meeting was attended by the following personnel:

ANDERSON, D. M.
CECIL, J. C.
CLARK, G. E.
WIRTHLIN, M. R.

WORK UNITS - FISCAL YEAR 1980

- 61153N MR04120 MR0412002 0408 - Evaluation of Therapeutic Agents for the Prevention of Oral Bone Destruction in Navy and Marine Corps Personnel
- 61153N MR041.20.02 0441 - Prevention of Dental Disease in Naval and Marine Corps Personnel by Inhibiting Plaque Accumulation
- 62758N F51524 ZF51524012 0002 - Evaluation of Antimicrobial Agents on Disease Producing Organisms of the Oral Cavity of Naval Recruits
- 62758N F58524 ZF58524012 0026 - Evaluation of Factors in Saliva and Plaque of Caries-Free Recruits of Potential Therapeutic Applicability for Preventive Dentistry
- 62758N ZF51.524.012 0027 - Development of Therapeutic Methods to Prevent Oral Diseases of Naval and Marine Corps Personnel
- 62758N F58524 MF58524012 0029 - Therapeutic Control of Periodontopathic Microorganisms in Naval Personnel
- 62758N MF58.524 MF58.524.012 0030 - Monitoring the Oral Health Status of Naval Personnel
- 63706N M0095PN M0095PN003 3008 - Evaluation of Expedient Procedures for Treating Dental Pulp Disease in Naval Personnel
- 63706N M0095PN M0095PN003 3010 - Wound Healing of the Supporting Tissues of the Teeth of Naval and Marine Corps Personnel
- 63706N M0095PN M0095PN003 3016 - Navy Dental Technician Utilization
- 63706N M00935.PN M00935PN003 3017 - Dental Equipment Development and Evaluation for Fleet Health Care
- 64771N M0933PN M0933PN001 0004 - Development of a Marine Corps Expeditionary Dental Shelter

INDEPENDENT RESEARCH WORK UNITS

- 61152N MR00001 MR0000101 0022 - An Evaluation of Cartilage Coating of Implants as Applied to Navy and Marine Corps Personnel
- 61152N MR00001 MR0000101 0023 - Pathogenicity of Vaporized Dental Casting Waxes in Naval Prosthetic Laboratory Environments
- 61152N MR00001 MR0000101 0024 - The Bacterial Flora of Incipient Occlusal Lesions in Naval Recruits

WORK UNITS - FISCAL YEAR 1980 (Continued)

61152N MR00001 MR0000101 0025 - Studies of Acute Pericoronitis in Navy and
Marine Corps Personnel

61152N MR00001 MR0000101 0026 - The Relationship of Oral Health and
Personnel Performance in Navy Recruits

RESEARCH PROGRESS REPORTS - FY 1980

NDRI-PR 79-06	Summaries of Research - Fiscal Year 1979
NDRI-PR 79-07	Structural Studies of Extracellular Glucans of <u>Streptococcus mutans</u> by Proton Magnetic Resonance
NDRI-PR 79-08	The Performance of Autoclaved High-Speed Dental Handpieces
NDRI-PR 79-09	Enzyme Histochemistry of Periodontal Pathogenesis in the Rice Rat (<u>Oryzomys palustris</u>)
NDRI-PR 79-10	Determination, by Carbon-13 Nuclear Magnetic Resonance Spectroscopy, of the Composition of Glucans Synthesized by Enzymes of the Cariogenic Organism <u>Streptococcus mutans</u>
NDRI-PR 79-11	Research Abstracts of 1979
NDRI-PR 80-01	Evaluation of the Navy Plaque Control Program at Great Lakes
NDRI-PR 80-02	Effects of Two Dextranase Preparations on Dental Caries and Alveolar Bone Loss in Hamsters
NDRI-PR 80-03	Periodontitis in the Rice Rat (<u>Oryzomys palustris</u>)
NDRI-PR 80-04	Comparison of the Effects of Ethane-1-Hydroxy-1,1-Diphosphonate and Dichloromethylene Diphosphonate upon Periodontal Bone Resorption in Rice Rats (<u>Oryzomys palustris</u>)
NDRI-PR 80-05	The Health of Naval Recruits: Dental Caries
NDRI-PR 80-06	The Problem of Occlusal Surface Pit and Fissure Dental Caries in Naval Recruits
NDRI-PR 80-07	Interim Progress Report on the Marine Corps Expeditionary Dental Shelter (MCEDS)
NDRI-PR 80-08	The Use of a New Topical Hemostatic Agent
NDRI-PR 80-09	Biologic Preparation of Diseased Root Surfaces
NDRI-PR 80-10	The Bacterial Flora of Incipient Occlusal Lesions in Naval Recruits
NDRI-PR 80-11	The Healing of Gingival Wounds in Miniature Swine
NDRI-PR 80-12	The Apparent Noninvolvement of the <u>B. fragilis</u> Group in Early Periodontal Disease

OTHER PUBLICATIONS

- Cowman, R. A., Schaefer, S. J., Fitzgerald, R. J., Rosner, D., Shklair, I. L. and Walter, R. G. "Differential Utilization of Proteins in Saliva from Caries-Active and Caries-Free Subjects as Growth Substrates by Plaque-Forming Streptococci." J. Dent. Res. 58:2019-2027, 1979.
- Gaines, J., Cotton, W. R. and Leonard, E. P. "Osteopetrosis." Comparative Pathology Bulletin 12:3-4, February 1980.
- Hancock, E. B., Mayo, C. V., Schwab, R. R. and Wirthlin, M. R. "Influence of Interdental Contacts on Periodontal Status." J. Periodontol. 51:445, 1980.
- Leonard, E. P. "Enzyme Histochemistry of Periodontal Pathogenesis in the Rice Rat (Oryzomys palustris)." Cell. Mol. Biol. 24:241-248, 1979.
- Leonard, E. P. "Animal Model of Disease - Periodontitis." Amer. J. Pathol. 96:643-646, 1979.
- Leonard, E. P., Reese, W. V. and Mandel, E. J. "Comparison of the Effects of Ethane-1-Hydroxy-1,1-Diphosphonate and Dichloromethylene Diphosphonate Upon Periodontal Bone Resorption in Rice Rats (Oryzomys palustris)." Arch. Oral Biol. 24:707-708, 1979.
- Mueller, E. J., Mayo, C. V., Wirthlin, M. R., Hancock, E. B. and Shklair, I. L. "The Apparent Noninvolvement of the B. fragilis Group in Early Periodontal Disease." J. Periodont. Res. 15:338-340, 1980.
- Seymour, F. R., Knapp, R. D., and Lamberts, B. L. "Structural Analysis of Soluble D-Glucans from Strains of Streptococcus mutans by C-Nuclear Magnetic Resonance Spectrometry." Carbohydr. Res. 84: 187-195, 1980.
- Shklair, I. L., Lamberts, B. L., Clark, G. E. and Wirthlin, M. R. "Streptococcus mutans and Dental Disease in the Navy." U.S. Navy Med. 71:28-32, 1980.
- Wight, T. A., Grisius, R. J. and Gaugler, R. W. "Evaluation of Three Variables Affecting the Casting of Base Metal Alloys." J. Prosth. Dent. 43:415-418, 1980.
- Wirthlin, M. R., Vernino, A. R. and Hancock, E. B. "The Use of a New Topical Hemostatic Agent." J. Periodontol. 51:225, 1980.
- Wirthlin, M. R. and Hancock, E. B. "Biologic Preparation of Diseased Root Surfaces." J. Periodontol. 51:291, 1980.
- Wirthlin, M. R., Yeager, J. E., Hancock, E. B. and Gaugler, R. W. "The Healing of Gingival Wounds in Miniature Swine." J. Periodontol. 51:318, 1980.

OTHER PUBLICATIONS (Continued)

Wirthlin, M. R. "Fellowships in Dental Research." U.S. Navy Med. 71:16,
August, 1980.

DISTINGUISHED VISITORS

October

Captain R. G. Shaffer, Commanding Officer, Naval Regional Dental Center, Great Lakes, Illinois.

CDR P. A. Furr, MSC, USN, Naval Medical Research and Development Command, Bethesda, Maryland.

November

Dr. William Yotis, Department of Microbiology, Loyola University, School of Medicine, Chicago, Illinois.

LCDR H. C. White, USMC, MCDEC, DEVCTR, Quantico, Virginia.

HMCS C. D. Crouch, HQMC, LM-4, Quantico, Virginia.

Dr. J. J. Hefferren, American Dental Association, Chicago, Illinois.

Dr. Charles Schoenfeld, American Dental Association, Chicago, Illinois.

DECEMBER

Dr. William Ludwick, Captain, DC, USN (Ret.), Wayzata, Minnesota.

Dr. Franklin Weine, Professor and Director, Postgraduate Endodontics, School of Dentistry, Loyola University of Chicago, Maywood, IL.

J. W. Lehm III, Marquette University, Milwaukee, Wisconsin.

CDR J. Brian, DC, USN, Naval Regional Dental Center, Bldg. 1017, Great Lakes, Illinois.

Kevin M. Kentrey, Marquette University, Milwaukee, Wisconsin.

Joseph L. Gaffing, Marquette University, Milwaukee, Wisconsin.

Dr. R. L. Chamberlain, Abbott Laboratories, North Chicago, Illinois.

JANUARY

Dr. R. L. Chamberlain, Abbott Laboratories, North Chicago, Illinois.

FEBRUARY

Dr. T. J. Lommel, Marquette University, Milwaukee, Wisconsin.

DISTINGUISHED VISITORS (Continued)

MARCH

Dr. Gatrell, Dr. Quinton, DA Holloway and DA Stevens, guest clinicians from Naval Regional Dental Center, Great Lakes for MCEDS trials.

Ms. Jan Baker, Resident Field Director, American Red Cross, Great Lakes, Illinois.

APRIL

Chief Saggio, Service School Command, Great Lakes, Illinois.

MAY

Dr. Scott Harper, American Dental Association, Chicago, Illinois.

JUNE

CDR F. J. Bienkowski, MSC, USN, Administrative Officer, Naval Medical Research and Development Command, Bethesda, Maryland.

DTCM J. L. Cox, Master Chief of the Command, Naval Medical Research and Development Command, Bethesda, Maryland.

CDR J. Mellonig, DC, USN, Naval Regional Dental Center, Great Lakes, Illinois.

CAPT R. Esposito, DC, USN, Naval Regional Dental Center, Great Lakes, Illinois.

SEPTEMBER

Colonel W. Parker, DC, United States Army.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS

CLINICAL INVESTIGATION DEPARTMENT

(Oral Diseases Division)

Evaluation of conservative pulp treatment for teeth with deep caries is continuing. In the diagnostic phase, clinical data obtained for 176 deeply carious teeth were compared with the histologic evaluation of each dental pulp's potential for healing. Significant clinical diagnostic variables from symptoms, history and tests were identified by chi-square analysis of response distributions according to the reversible/irreversible microscopic judgement of pulp disease. The clinical usefulness, or predictive value, of each significant variable was determined from the percentage of truly classified cases eliciting a response among all cases eliciting the response. The most valuable clinical predictors of reversible pulpitis were: caries involvement of less than 3/4 dentin thickness radiographically; lack of periapical periodontal ligament (PPDL) space enlargement on radiograph; a history of no pain or mild, moderate pain; pain duration less than one minute; normal response to percussion, with no history of pressure sensitivity; no periapical condensing osteitis (sclerosis) radiographically; and response to hot, cold or electric pulp test (EPT). Conversely, the best clinical predictors of irreversible pulp disease were, in order: presence of periapical condensing osteitis; a history of pain duration more than one hour; no response to cold, hot or EPT when control does respond; a history of spontaneous pain; radiographic enlargement of PDL space; a history of pressure sensitivity; and a history of severe pain intensity. These criteria are now being used to classify the reversibility of pulpitis at pretreatment, post-treatment and recall exams of deeply carious teeth included in the long-term assessment of conservative pulp therapy alternatives.

The long-term assessment phase of conservative pulp therapy now includes 497 teeth which had been infected with caries at least three-fourths the dentin thickness ("U"-lesion) and radiographically did not appear to have entered the pulp tissue. The number of these "U"-lesions with known records of treatment and treated conservatively by leaving the pulp intact was 312 or 86%. The distribution of the conservative treatment techniques was: all caries removed, 215; indirect pulp cap, 45; and direct pulp cap, 52. There is no record of treatment for 133 teeth; and the remaining 52 teeth were treated by pulpotomy, 17; root canal filling, 17; and extraction, 18.

Comprehensive diagnostic data for the "U"-lesion teeth were obtained by NDRI investigators. Thorough treatment data were also recorded according to the clinician's choice of treatment methods. By evaluating radiographs, histories, and results of clinical tests at yearly intervals, the most reliable procedures and materials for treating pulp disease under deep caries will be determined. Data for yearly recall examinations of conservative treatment of 128 "U"-lesions is presented below. Successful/unsuccessful criteria were redefined based on the clinical and histologic evaluations for 176 teeth as described earlier for the diagnostic phase of this study. Successful treatment was indicated by absence of symptoms or presence of mild or moderate symptoms; any positive response to pulp tests; and absence of, or improvement in radiographic evidence of pathology.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

Success Rates of Techniques for Conservative Treatment of 128 "U"-Lesions at the Recruit Dental Clinic, Great Lakes, Illinois

Recall Year	All Caries Removed		Indirect Pulp Cap		Direct Pulp Cap		All Treatment	
	%	N	%	N	%	N	%	N
1	†82	(68)	79	(14)	82	(17)	82	(99)
2	85	(41)	86	(7)	88	(8)	86	(56)
3	95	(20)	100	(5)	80	(5)	93	(30)
4	100	(10)	100	(4)	67	(3)	94	(17)

†Percent successful treatment (total number of teeth).

The success rates for all treatments are 82 and 86% at the one- and two-year intervals respectively, while current data show 93 and 94% success at three- and four-years respectively. Based on these results tabulated for end of FY80, the "All Treatment" overall success becomes approximately 80% for all recall intervals. Adding the total numbers of teeth for each recall year in the All Treatment column will result in a grand total greater than 128. This is because one tooth may not have recall data for year one, but may have data for years two and three. The data for that tooth would be recorded in years two and three, but not year one.

Work during the phase which is seeking to determine the agent(s) in caries which induce pulp disease has been hampered by problems encountered in pulp testing vascular permeability factor (PF) in primate teeth. Nonetheless, observations thus far indicate caries PF, presumably produced by microorganisms, is capable of causing adverse inflammatory changes and vacuolization of fibroblasts in the dental pulp. More trials are being conducted to determine optimum test conditions and treatment intervals for best observation of short- and long-term influences of PF on the pulp tissue.

Twenty-one oral organisms have been surveyed for their capability of producing PF. Three organisms were found to produce PF in their extracellular growth medium - Streptococcus mutans, strain sl-1, and two strains of Lactobacillus fermenti. This finding lends credence to the assumption that PF is a toxin of bacterial origin.

Increased yields of purified PF from carious dentin extracts have resulted in the finding of four PF-active molecules. This finding was demonstrated by subjecting the purified PF preparation to acrylamide gel electrophoresis experiments. At the end of electrophoresis, PF activity was recovered from

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

gel slices which corresponded to all four bands stained by a protein dye. All other slices which corresponded to non-staining areas were negative for PF activity. When sufficient supply of the purified PF preparation is available, the four molecular species will be separated from each other by preparative acrylamide gel electrophoresis. Until then, testing of the purified PF will be as an active PF group of four and no contamination of a non-PF active species.

The potential anti-carries effect of a commercially available mouthrinse containing 0.05 percent sodium fluoride is being evaluated. Determination of the effect of its use on the concentration of fluoride in dental plaque and on changes in the microbial composition of the plaque. A double-blind study involving 300 naval recruits is presently at the half-way point in subject accumulation. The population was characterized clinically as having a mean DMFS of 15.9, with a range of 0 to 62. Two plaque samples were obtained, prior to issuing the mouthrinse; on the first day of training and during the third week of training. The mean plaque fluoride levels of the subjects was 4.62 ng/mg of plaque. The mean counts of Streptococcus mutans, lactobacilli, and total plaque microorganisms were 5.46×10^4 , 6.45×10^4 , and 2.70×10^6 CFU/mg of plaque, respectively. The code for the double blind assignments of the fluoride and placebo mouthrinses has not, as yet, been broken. An analysis of the pre-rinse data indicated no significance or trends in the amount of fluoride in plaque and the DMFS levels of the subjects. There was, however, a trend between the microorganisms S. mutans, lactobacilli and total plaque microorganisms and the DMFS ranges. The higher the DMFS the greater the numbers of these organisms.

The results of the fluoride mouthrinse at the conclusion of the study will be used to evaluate the potential anti-carries effect of the rinse and could provide a basis for initiating a full scale clinical trial.

Extracted human teeth with areas exposed to periodontal disease processes were scaled free of calculus in the laboratory and sectioned into mesial and distal halves. The diseased area of one half of each tooth was treated with phosphate buffered saline (PBS). The diseased root surface of the other half was treated with Plasma Protein Fraction (Human), 5%, USP (PPF) which is about 92-95% albumin. The teeth were incubated in a human gingival fibroblast cell culture for 48 hours, and the number of attached fibroblasts per unit area were counted. There was no significant difference between the PBS and PPF specimen cell counts. Immune Serum Globulin (Human), USP, (ISG) was also tried. Although the results showed an improved effect by the use of the gamma globulins of ISG, the cell counts were not statistically different. The alpha and beta globulins of human plasma fraction Cohn IV₁ (Wirthlin and Hancock, 1980) appear to be more effective in binding or degrading endotoxin adsorbed on diseased root surfaces.

The outer sheath of spirochetes can be removed by sodium deoxycholate (NaD) and other surface-active agents such as Triton X-100, sodium dodecyl sulfate or sodium lauryl sulfate (SLS) in low concentrations. Ethylenediamine

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

tetraacetate (EDTA) improves the effect, because reaggregation of the sheath material (where endotoxin is found) is cation dependent. We prepared a solution of 0.04% SLS with 0.2% Na₄EDTA and applied it to diseased root surfaces, with PBS as a control treatment. There was no significant difference in fibroblast cell counts.

The treatment of vigorously root planed diseased root surfaces with citric acid, pH 1, is currently under investigation in periodontics. It is based on the concept that acid etching may unmask collagen fibers within the hypermineralized diseased root surface, and the collagen fibers could subsequently unite with those in the gingival flap to create a connective tissue new attachment. It is conceivable that citric acid may extract and denature the endotoxin. Testing a fresh saturated solution of citric acid, pH 1, in our in vitro gingival fibroblast system produced no statistically significant difference from PBS controls in number of attached cells.

In an experimental application of the diseased root surface treatment developed in vitro, periodontal pockets were surgically created about upper incisor teeth in 31 Macaca mulatta (average age 90 months), and the pocket depths were maintained with subgingival plastic bands for approximately 50 days. Smears from these chronic periodontal pockets disclosed Gram negative and positive microorganisms. Teeth were assigned to experimental and control groups such that there was no significant difference in pocket depth, width of gingiva, amount of attached gingiva, or recession from the initial gingival margin level. Two weeks after band removal, internal bevel incisions were made and pedicle flaps 3 mm wide were raised on the midfacial radicular surface. The pocket lining was excised at the depth of probing with a scalpel, making a nick in the root surface at that level. Any visible subgingival deposits were carefully scaled off but no intentional root planing or cementum removal was attempted. The exposed roots were treated by rubbing for one minute with cotton pellets soaked in PBS (controls) or with first 2% NaD, then 5% Cohn fraction IV₁. The pedicles were returned to place and held with finger pressure over a damp surgical sponge for 2 minutes. Animals were placed on a soft diet. Evaluation was done at 0, 2, 7, 14 and 21 days on experimental, control, and unwounded specimens by rupture strength, collagen analysis, and histologic examination. All PBS-treated wounds healed by formation of a long junctional epithelium (JE) from gingival margin to the nick in the root, and in some cases a new pocket. One 7-day experimental specimen had a long JE attachment, but the other two had a loose connective tissue new attachment from the cemento-enamel junction to the nick. One 14-day sample also had long JE, but two had part JE, part connective tissue new attachments. At 21 days, two specimens had long JE and four had part JE, part connective tissue new attachment coronal to the nick. Rupture strengths at 21 days were experimental 180g \pm 193 (S.D.), control 37g \pm 44, and unwounded 125g \pm 56 (N=4). Collagen production percent of total protein synthesis was experimental 10.4% \pm 1.8, control 8.9% \pm 2.1, unwounded 8.8% \pm 1.0 (N=4). This preliminary study indicates that it may be possible to obtain connective tissue new attachment of soft tissue coronal to the crest of the alveolar process by

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

biologic treatment of diseased root surfaces. These procedures have been applied to treatment of posterior segments of induced periodontal disease in monkeys. Specimens with 90 days healing are now being prepared for histologic examination.

(Trauma and Surgical Problems Division)

A retrospective study has been completed to determine the clinical and radiologic criteria which may be used for the selection of mandibular third molars at high risk of developing acute pericoronitis. It was determined that 77% of all third molars were present in recruits reporting for training. Acute pericoronitis was present in 1.8% of the individuals at entry. Another 0.6% suffered onset of the disease during the eight-week training period even though 15% of all third molars were extracted early in the period.

The accuracy of measurements made from repeat panoramic radiographs were evaluated. In ten volunteer subjects, comparison of distances and angles between radiopaque points projected on the films disclosed that measurements in the immediate area of third molars varied 0.2 to 3.2% on repeat films.

Subsequently, comprehensive clinical and radiographic data were collected for 25 cases of acute pericoronitis and 109 unaffected subjects. Using radiographic measurements of the mandibular third molars in relationship to other anatomic structures, as well as clinical indices of dental caries, plaque and soft tissue diseases, correlations between these factors and the presence or absence of acute pericoronitis were determined. Analysis identified six variables that may be used as predictors of mandibular third molar acute pericoronitis; length of the tooth, height of the tooth in relationship to the forward adjacent tooth, tooth angulation to the plane of occlusion, degree of encapsulation, number of sound teeth and Navy Plaque Index score. The value of these criteria to identify future risk of disease will be tested in a prospective study of a large military population.

Cartilage cells (chondrocytes) were established as a cell culture line from biopsies of monkey (Macaca fascicularis) tissue. We were able to culture them upon unplated and carbon-plated titanium dental implants. However, the attached cell populations were too sparse to proceed with plans to implant chondrocyte-implants into the jaws of monkeys.

(Dental Care Delivery Division)

The monitoring of the oral health status of naval recruits at Great Lakes is continuing. In addition, the surveillance of the oral health status of non-recruit personnel was begun in Fiscal Year 1980. A total of 383 recruits (254 service school selected and 129 randomly selected) were examined during their first week of recruit training. Indices of caries experience (DMFS, DMFT) and periodontal disease status (NPDI, NPI) were obtained to estimate the prevalence of dental disease in the recruit population. Samples of saliva were obtained from which the total counts of cariogenic bacteria

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

could be determined. A summary of the dental disease status of recruit subjects is presented in Table 1. The recruits have a high prevalence of dental caries; gingivitis is universal.

Six-month follow-up data have been obtained from 61 of the recruits who remained at Great Lakes for further training (i.e., service school selected). The incidence of dental caries within six months has been related to initial salivary bacterial counts obtained from 61 subjects. Sixty-seven percent of the sample (N=40) developed at least one carious tooth surface during the six-month observation period. There was a tendency for the counts of both S. mutans and lactobacilli to be elevated for those who developed caries compared to the counts for those who did not develop caries. With this limited sample of subjects, we believe that salivary counts of cariogenic bacteria may not be useful in identifying individuals who have a high, six-month caries risk. Longer term (one, two, three year) data are needed to test the predictive efficacy of microbiological counts.

A total of 105 nonrecruit, Naval Base staff subjects have been examined at dental recall appointments (baseline), using the same indices as used for the recruit sample. After some initial problems with sample response rate, the overall response rate is now 38 percent (105 examined/277 randomly selected). Compared to recruits, the nonrecruit subjects have fewer carious surfaces, more filled tooth surfaces, and a higher overall score for caries experience. Nonrecruits have less dental plaque (NPI) adherent to their teeth than recruits at the time of examination. Table 1 compares the disease index values for recruits and nonrecruits.

Table 1

Dental Health Status of Naval Personnel at Great Lakes, 1980
Mean Index Scores**

Index	Service School Selected N=254	Recruits	Nonrecruits
		Random Selected N=129	Annual Recall Sample N=100
DMFS	18.6	16.9	32.6
DS	5.9	5.4	1.1
MS	3.6	2.7	8.1
FS	9.2	8.8	23.4
<u>S. mutans*</u>	77.4	70.5	14.5
LACTO*	18.6	21.0	4.4
NPI	83.3	89.7	69.4
Age	19.2	19.2	28.8

*x10³ CFU/ml of saliva.

**significant difference between groups, p < .05.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

Clinical trials of endodontic treatment utilizing various combinations of dental operating rooms (DOR's) and trained auxiliaries have been completed with the cooperation of the staff of the Naval Regional Dental Center, Great Lakes, Illinois. The value of productivity was measured with both the Navy Dental Information Retrieval System (DIRS) profile and fees based on surveys of civilian dentists. Value of services was compared with the cost of salaries, facilities, equipment and supplies. Trials demonstrated that an endodontist's effectiveness increased 67% when he and a Navy general dental technician (DT) utilized two DOR's instead of one. There was a corresponding increase in the value/cost ratio from 1.77 to 1.92. With the substitution of an endodontic dental technician (EDT) specially trained to assume additional tasks, in place of the DT, effectiveness increased an additional 35% in the two DOR's and the value/cost ratio improved to 2.17. The utilization of a second auxiliary, either DT or EDT, increased percent effectiveness in the two DOR's, but the value/cost ratio remained unchanged. It was concluded that task-oriented, on-the-job training of endodontic auxiliaries and utilization of a second DOR are both cost-effective measures for increasing an endodontist's productivity.

The Marine Corps Authorized Dental Allowance List (ADAL) of standard dental equipment and supplies was obtained and installed in a 8'x8'x20' wooden mock-up of a Marine Corps Expeditionary Shelter (MCESS). It was necessary to substitute a new chair and film developer for Authorized Dental Allowance List (ADAL) items which were no longer available. The present field light was found to give poor illumination and was mounted on an unsteady tripod. A fiber-optic replacement light, which is currently being used by some field units, was evaluated and found to perform satisfactorily. The light was mounted to an adjustable pole attached to the field dental unit which provided an instrument delivery system that proved adequate in preliminary clinical trials.

Trials of the Marine Corps Expeditionary Dental Shelter (MCEDS) were conducted utilizing teams of dental officers and technicians, and patients supplied by the Naval Regional Dental Center, Great Lakes. The trials included the placement of Class I and II alloys, Class III composites, T-2 exams, the exposure and development of bitewing radiographs, prophylaxes, scalings, and the extraction of unimpacted teeth. In addition, models were supplied to simulate situations requiring stabilization of an alveolar fracture, root canal preparation and fillings, and repairs to prosthetic appliances. All participants were observed and interviewed for their subjective evaluation of the MCEDS in operation. Compressor noise, which was expected to be a problem, was found to be tolerable by providers and patients alike. The noise level was tested and found to be within the limits promulgated by the Navy (OSHA 1910.95).

The first trials in the mock-up demonstrated that the current ADAL could be fitted to a rigid MCEDS and that the required range of dental procedures could be easily accomplished.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

CLINICAL INVESTIGATION DEPARTMENT (Continued)

Work is currently underway on the second phase of the MCEDS project. New standard-stock replacement items for the ADAL are being installed and evaluated in the mock-up at NDRI. The new items will consist of fixed cabinetry, an over-the-patient, lightweight, delivery system with an innovative chair-unit combination and a tray instrument system. Equipment and supplies will be tailored to the MCEDS and tested to determine function acceptable under field conditions.

Dental medicaments and consumable supplies of the ADAL, which are routinely used intraorally, were environmentally-stressed to determine the effects of extremes in temperature. Materials in storage and in potential Marine Corps combat areas of the future are likely to be exposed to extreme heat or cold temperatures. ADAL materials were placed in hot and cold controlled environmental chambers with samples removed and evaluated at 24, 72 and 120 hours. The effects on performance, hardness, durability, texture, and the mixability of the various materials were evaluated. Many of the materials were found to undergo deleterious effects. For example, heat caused mixing and setting problems of the silver alloy, anterior filling material and calcium hydroxide. After cold, there were setting problems with acrylic and damage to anesthesia carpules.

Dental materials and equipment being stored or transported by Navy and Marine dental units in combat environments are often subjected to corrosive effects. Selected dental instruments and devices were placed on two high humidity chambers for 30 days each; one represented the marine (salt water) environment, the other a control (fresh water) environment. The instruments in the marine, high humidity environment demonstrated marked corrosive effects, while those of the fresh water environment suffered rather minor deleterious effects. These instruments are presently undergoing macroscopic and microscopic analysis. Results of testing will be used to formulate recommendations for preventing environmental deleterious effects on dental instruments in storage and transit.

The investigation of autoclavable, air-driven high-speed dental handpieces is continuing.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT

(Microbiology Division)

Anaerobic bacteria appear to play an important role in the development and progression of periodontal disease. The Gram negative bacteria, notably Bacteroides and Fusobacterium species, have been observed in greater numbers from sites where periodontal disease exists than at healthy sites. Six surface active agents were examined for their antibacterial activity in an effort to provide alternatives to antibiotics for the control of these Gram negative bacteria within the oral cavity. Fresh clinical isolates were collected from 12 patients with chronic periodontal disease pockets greater than 3 mm in depth, and who had received no antibiotics or other periodontal therapy for 3 months prior to sampling. Specimens were placed in prereduced anaerobically sterilized broth for transport to the laboratory.

In the laboratory, specimens were agitated for 20 seconds with a Vortex mixer and aliquots were streaked onto blood agar, Todd-Hewitt agar with clindamycin (50 ug/ml) and trypticase soy agar with 5% blood, crystal violet, and erythromycin (5 and 4 ug/ml respectively) and incubated anaerobically at 35-37°C for 48 hours. Isolates cultured on Lombard-Dowell medium were identified with API 20A identification strips and by gas-liquid chromatography.

Isolates of B. melaninogenicus ss intermedius, B. ochraceus and F. nucleatum were readily obtained, but no cultures of E. corrodens were isolated.

The susceptibility of five strains each of the isolates to cationic, anionic and nonionic surface active agents were determined by inoculation of serial dilutions of each agent in Lombard-Dowell broth incubated anaerobically at 35-37°C for 48 hours and then subcultured onto blood agar. The minimum inhibitory concentration for each compound was that which prevented growth of the inoculum as evidenced by lack of turbidity in the broth dilution. The minimum bactericidal concentration was that which yielded no viable bacteria upon subculture.

Benzalkonium chloride, cetylpyridinium chloride and sodium lauryl sulfate were inhibitory to the oral anaerobes tested in very low concentrations (25 to 50 ug/ml or less). The nonionic detergents tested, Tween 80 and Tween 60 and the anionic detergent Teepol 610 did not inhibit the test strains of bacteria in concentrations of 100 ug/ml and therefore do not show the promise of the other compounds as antibacterial adjuncts to periodontal therapy and preventive dentistry.

Streptococcus mutans produces water-soluble and insoluble glucans when grown in the presence of sucrose. These glucans, particularly the insoluble glucans, promote the development of dental plaque and have been implicated as a virulence factor in the development of dental decay.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

The enzyme, glucosyltransferase (GTF), normally found in S. mutans is responsible for the synthesis of the glucans. A number of compounds were tested for their ability to interfere with glucosyltransferase synthesis of insoluble glucans. The glucosyltransferases used in the assay system were recovered from culture supernates of S. mutans strains K-1R or NTCC #10449. The glucan synthesizing activity of the enzymes in the presence of the test compounds were compared to control incubations with no test compound present. The procedure determining the amount of glucans synthesized was done as previously described (Shklair, et al., AADR Abstract #520, 1980).

The following test compounds were evaluated. Tween 40, 60 and 80; Teepol 610; calcium, magnesium, zinc, and manganese salts; thioglycollic acid; monolaurin; sodium lauryl sulfate (SLS); cetylpyridinium chloride; cetyltrimethyl ammonium bromide; benzathonium chloride; methylbenzathonium chloride; chlorhexidine; and phospholipids. Tween 40, 60, and 80, were tested at concentrations ranging from 0.002 percent to 5.0 percent, and were not effective in the inhibition of GTF at the concentrations tested. The detergent, Teepol 610, was effective in inhibiting 70-80 percent of GTF activity, but only when used at a concentration of 4 or 5 percent.

The calcium, magnesium, zinc, and manganese salts, as well as the phospholipids were ineffective in the inhibition of insoluble glucans.

Thioglycollic acid at 0.1 percent and monolaurin at a concentration of 0.5 percent inhibited GTF activity 25 and 75 percent respectively.

The compounds that were most effective at low concentrations were: sodium lauryl sulfate, cetylpyridinium chloride, cetyltrimethyl ammonium bromide, benzathonium chloride, methylbenzathonium chloride, and chlorhexidine. SLS at a concentration of 0.005 percent inhibited 82 percent of insoluble enzyme activity, and at a concentration of 0.007 percent inhibited 95 percent of enzyme activity. A concentration of 0.004 percent cetylpyridinium chloride inhibited 97 percent of the enzymes insoluble glucan synthesizing ability. At 0.2 percent cetyltrimethyl ammonium bromide inhibited 100 percent of the GTF activity, and at 0.01 percent benzathonium chloride and methylbenzathonium chloride also completely inhibited the enzymes activity.

Chlorhexidine at 0.1 percent caused an 88 percent inhibition of the enzymes.

There were little differences in the results whether the GTF was derived from strain K-1R or 10449.

Compounds that are effective GTF inhibitors at low concentrations could prove to be suitable for incorporation into mouthwashes, pastes, gels or other vehicles. Such compounds properly dispensed could be used to control dental plaque formation and reduce the caries incidence in a military population.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

An α -1, 3-glucanase (Mutanase) was found very efficient in solubilizing the water-insoluble bacterial glucans associated with dental plaque deposits. This mutanase was isolated and characterized. Isoelectric focusing revealed mutanase activity in a pH range of 4.8 to 5.9. The molecular weight(s) of the α -1, 3-glucanase was determined by interpolating from a linear regression curve of the elution volumes of known molecular weight standards resolved by gel permeation chromatography. Two peaks were found corresponding to molecular weights of 279,000 and 67,400. The two activity peaks may represent the aggregated enzyme separated from its subunits.

The 1, 3-glucanase did not exhibit any dextranase or amylase activity when induced on a "limit-glucan" substrate. The greatest activity was always toward the α -1, 3-limit glucan substrate with lesser activity toward an insoluble "B" glucan (i.e., some α -1, 6-glucan linkages present).

The end products of mutanase activity were studied using a "limit-glucan" substrate. The enzyme could solubilize at least 38% of the insoluble glucan, and the presence or absence of dextranase did not affect the solubilization. This finding could have a great practical application as a means of solubilizing dental plaque deposits.

An in vitro assay showed that the mutanase caused a reduction in total adherence of radioactive labeled Streptococcus mutans to hydroxyapatite (artificial tooth) surfaces in the presence of sucrose. Untreated samples in this system had greatly increased surface bacterial populations relative to an analogous glucose-grown system. These sucrose-dependent glucans appear to be essential for accumulation and build-up of plaque-forming bacteria. Our work indicates that certain enzymes can prevent this plaque accumulation.

Previous data indicated that a dextranase which can strongly adhere to hydroxyapatite (HA) can also provide greater protection from dental caries. The protective mechanism could involve the prolonged hydrolytic activity of the enzyme on the tooth surface and thereby making the enzyme continuously available for degrading plaque glucan components. We have continued to explore methods of covalently bonding plaque glucan degrading enzymes, such as dextranase, to protein carriers as an improved anti-plaque agent. Coupling reagents such as glutaraldehyde, ethyl chloroformate, *m*-maleimidobisuccinimide, Woodward's reagent K (WRK) and others have been tested. The only evidence of increased adsorption of dextranase activity onto HA was observed when WRK was used as the coupling reagent. However, the yield of protein conjugated to dextranase by WRK was too low to make this a practical procedure. Further work will involve conjugating a dextranase with a high affinity for HA with another plaque degrading enzyme (mutanase) so that two enzymatic activities could be retained on the enamel surfaces, providing continuous specific cariogenic plaque control.

An attempt was made to control dental caries in the mouths of naval personnel with a stannous fluoride gel placed on Super-Floss and applied once to the interproximal space of the teeth. It is thought that in the absence, or the presence of few S. mutans at an interproximal site, no smooth surface

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

lesions will develop. If the stannous fluoride treatment eliminates or greatly reduces the organism from a particular site, that area should become less prone to caries attack.

To date 26 subjects have had all their carious lesions restored; 16 received a dental floss-delivered fluoride treatment and 9 served as controls - treated with saline. Thirteen of the treated patients have been followed for a one-year period. The remaining patients are 6 to 7 months into the study. Eight of the 10 control subjects have been sampled for the one-year observation period; the other control patients have been studied for 8 to 9 months.

Prior to the fluoride treatment 92 percent of the sites sampled in the experimental group were infected with S. mutans; 85 percent of sites sampled in the control group were infected with S. mutans. The table below shows the data on the effectiveness of the fluoride treatment; it indicates the percentage of sites that become negative for S. mutans and a percentage of the sites that had a reduction of at least 50 percent of their S. mutans, over a specified time period.

The Effect of Stannous Fluoride on the Elimination and Reduction of S. mutans at all the Posterior Interproximal Tooth Sites

Time Months	No. Patients	Percent of Sites	
		Reduced to 0	Reduced 50-100%
1	16	30	60
2-4	16	19	47
4-6	16	17	51
6-8	15	21	52
8-12	13	19	52

From 2 to 12 months, the one-time application of stannous fluoride completely eliminated S. mutans in the plaques of 20 percent of the sites. From 47 to 60 percent of the treated sites (including the 20 percent reduced to 0) lost at least half of the numbers of S. mutans that were originally present and maintained that reduction over the year's observation period.

The fewer S. mutans present at a site, the better were its chances of becoming negative, and conversely, the greater the number of organisms present the less likelihood of its becoming negative.

The control subjects did not greatly vary in the numbers of S. mutans present or the sites infected after receiving saline in place of the fluoride.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

There was a trend indicating that stannous fluoride was most effective against the organisms at the bicuspid-cuspid area and least effective at the 1st and 2nd molar interproximal spaces. See table below:

The Effect of Stannous Fluoride on the Elimination and Reduction of S. mutans at Selected Posterior Interproximal Tooth Sites

Interproximal Areas Sampled	Months				
	1	2-4	4-6	6-8	8-12
	Percent of Sites Reduced to 0 or 50-100 Percent				
	0; 50-100	0; 50-100	0; 50-100	0; 50-100	0; 50-100
a. 1st-2nd molar	23 - 65	7 - 39	15 - 53	18 - 48	9 - 47
b. Bicuspid-1st molar	29 - 58	16 - 61	13 - 50	20 - 46	17 - 52
c. Biscuspids- bicuspid	32 - 52	15 - 33	16 - 50	16 - 45	14 - 40
d. Bicuspid- cuspid	40 - 62	19 - 51	20 - 50	27 - 57	19 - 51

Data from NDRI epidemiological studies on the development of new lesions in young naval personnel, indicated that the areas around the 1st and 2nd molars are the most susceptible to new decay. Although there was a reduction of S. mutans around the susceptible area following fluoride treatment, it cannot be determined in this one-year study whether this reduction was large enough to prevent decay because the observation time was limited. Two of the fluoride-treated subjects each developed one new carious lesion at a treated site one year after the one-time treatment. These lesions in treated subjects were at the 1st molar-2nd molar contact which was very heavily infected, and these subjects had high levels of S. mutans throughout the study. One of the control subjects developed one posterior proximal lesion after the one-year observation period. These patients have been referred to their dentists for treatment.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

(Biochemistry Division)

Certain protein and peptide components of saliva can be metabolized by oral organisms to organic bases which can neutralize bacterial acids, and thus may function as anticaries agents. The elaboration of these basic products elicits a salivary pH-rise response. Earlier we reported that the mean pH-rise profiles of whole saliva samples from 52 caries-free recruits were found consistently at higher pH than the corresponding profiles from 52 caries-active recruits. In a continuation of this work, we have compared the pH-rise enhancement by salivary sediments and five pure oral strains, conducting the measurements on salivary supernatants from 24 caries-free and 23 caries-active recruits. These were also the subjects providing the salivary sediments. The pH-rise profiles were obtained using washed cells of Streptococcus mutans, Streptococcus sanguis 10556, Actinomyces viscosus, Streptococcus salivarius, and Lactobacillus casei. Although there was overlap among profiles within each comparison, the mean pH-rise profiles for the caries-free subjects were higher in all cases than the corresponding profiles of the caries-active subjects. Concomitant tests of salivary sediments with 3.33 mM arginine rather than the salivary supernatant fractions also produced higher mean profiles for the caries-free subjects. The comparisons among the strains showed sharper responses for the Strep. sanguis and L. casei than was observed for the sediments, but there was essentially no pH-rise responses for the other strains. It was concluded from these studies that: (a) the higher mean pH-rise profiles consistently found for the caries-free subjects reflected differences in the nature (probably of microbial composition) of salivary sediments as well as in the composition of salivary supernatants; (b) the strong responses of Strep. sanguis and L. casei suggest that these strains could provide more sensitive and reproducible assessment of salivary pH-rise potential than salivary sediment; and (c) salivary pH-rise-inducing factors may be important mechanisms to account for differing degrees of cariogenicity of oral organisms--for example, of Strep. sanguis compared to Strep. mutans.

We have also attempted to determine fluorimetrically whether the pH-rise-enhancing components of saliva, such as sialin or other peptides, may occur in different amounts in caries-free and caries-active subjects. However, no evidence has been adduced, to date, from fluorimetric data on electrophoretically-separated peptides from approximately 20 caries-free and 20 caries-active whole saliva supernatants to indicate that caries-free subjects have significantly higher free levels of these components than their caries-active counterparts.

(Histopathology Division)

Environmental safety specific to the dental laboratory involves the potential hazard produced by the vaporization of waxes during the dental casting burn-out process.

To simulate dental prosthetic laboratory conditions, groups of test rats were exposed to concentrations of wax vapors normally found in large naval dental

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

SCIENTIFIC DEPARTMENT (Continued)

prosthetic laboratories. Following 5 consecutive days of exposure, the animals, along with corresponding non-exposed controls, were euthanized for histometric, histopathologic and biochemical evaluation. In a standard analysis of the recoverable alveolar macrophages, the exposed and non-exposed animals displayed similar numbers of cells. Biochemical analysis of the activity of lung α -glucuronidase and acid phosphatase also revealed no significant differences in exposed as compared to control animals. Scanning electron microscopic comparison of distal airways and alveoli revealed particulates along ciliated surfaces and alveolar walls in both experimental and control animals. Morphologic observations revealed no cytotoxic effects. However, in pilot procedures with higher wax vapor concentrations, a number of rats presented dry, necrotic tails, limbs, cloudy cornea, and death of the animal.

Periodontal bone loss occurs rapidly in the rice rat (Oryzomys palustris) and it has been used as a model of bone-destructive periodontal disease in a number of experiments in our laboratory. We have isolated Strep. sanguis, Strep. faecalis, Staph. aureus and A. viscosus from lesions, but no capnocytophaga. Although the primary pathogen has not been determined, antimicrobial treatments have been found effective in preventing bone loss. Chlorhexidine at 2% concentration is effective, as well as at 0.2% if done daily. Other agents have not shown statistically significant effects except for 10% stannous fluoride (SnF_2). SnF_2 used as a topical treatment for the prevention of dental caries has an antibacterial effect, and significantly reduced bone loss compared to controls when done twice in 60 days in our test system.

STATEMENT OF SIGNIFICANT ACCOMPLISHMENTS (Continued)

ADMINISTRATIVE DEPARTMENT

Energy management has received notable attention and support during the year. Three facility projects completed during the year achieved a reduction of consumed energy resources. A special project for improvements to the animal colony facility, leading to certification, was funded and initiated. The Naval Dental Research Institute recently implemented a support agreement with the Personnel Support Detachment, Naval Regional Medical Center, Great Lakes for "personnel" services. The support agreement with the Naval Regional Medical Center was also reviewed and revised.

The Administrative Department continued an effective supporting role during the FY80 project year. The long-vacated supply clerk position was filled to become a part of the mechanized structure of the authorization accounting activity provided by the Naval Regional Medical Center. By developing and publishing a comprehensive job order and cost accounting plan and by redefining and improving the local accounting structure, the Department increased efficiency for support of investigators conducting dental and oral health research among five program elements.

The Photographic and Graphic Arts Branch has continued a vital support role for investigator-project accomplishments. During the year more than 200 original graphs and charts, 2600 negatives, 3400 prints, and 4100 positive slides (diazos) were produced. Two members of the Naval Dental Research Institute audio visual support team received recognition for their outstanding performance.

During the year all eligible employees and supervisors completed the formal Merit Pay Training program under the Civil Service Reform Act. The Naval Dental Research Institute hosted the Dental Officer Casualty Care Treatment training program administered by the Naval Regional Dental Center, and participated in the Summer Aid Program (CETA) by employing and training two students. Five research scientists received special training in the Career Development Program. One Petty Officer completed his baccalaureate degree in health care administration and is expected to complete his masters degree during the next year. Several members completed varied training through courses of instruction, seminars, and off-duty education which has enhanced accomplishment of the activity's mission.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS,
DEPARTURES AND REENLISTMENTS

OCTOBER

LT S. A. LEONE was augmented in the regular Navy.

CDR G. E. CLARK was promoted to Captain.

Mr. E. J. MANDEL transferred from the Dental Care Delivery Division to the Center for Disease Control, Atlanta, Georgia.

LT F. AKER was selected for Lieutenant Commander.

Dr. I. L. SHKLAIR received a 30-year pin and certificate of government service.

A certificate of completion for the 1979 Great Lakes Executive Career Development Program was received by:

B. L. LAMBERTS
I. L. SHKLAIR
L. G. SIMONSON

NOVEMBER

LCDR J. C. CECIL was presented with a letter of appreciation as a special lecturer to the National Naval Dental Center from the Commanding Officer, National Naval Dental Center, Bethesda, Maryland.

DECEMBER

CDR R. G. WALTER received a Bachelor of Science degree from the University of Maryland with a major in business management.

Dr. L. G. SIMONSON and Dr. B. L. LAMBERTS' patent entitled "Plaque Dispersing Enzymes as Oral Therapeutic Agents by Molecular Alteration," was selected for the Navy Exhibit at the World's Fair for Technological Exchange.

JANUARY

DM M. P. GOLDING was advanced to DT3 (E-4).

LCDR J. C. CECIL was promoted to Commander, DC, USN.

Ms. V. BALLANTINI resigned from the Office Services Branch of the Administrative Division.

DT3 D. PORTIS joined the staff from the USS Enterprise.

**HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,
AND REENLISTMENTS (Continued)**

MARCH

Dr. I. L. SHKLAIR was re-elected as the Program Chairman of the Microbiology/Immunology Section of the American Association for Dental Research/International Association for Dental Research.

Dr. L. G. SIMONSON received an Outstanding Performance Award.

Mr. J. TINDIRA retired from civil service after 37 years.

Mr. A. E. DEMPSEY resigned from the Microbiology Division.

Mr. A. SEROWSKI joined the staff as the Biomedical Engineer in the Facilities Support Branch, Dental Care Delivery Division.

Ms. J. RAMIREZ joined the staff in the Fiscal and Supply Division.

Ms. S. KLINE joined the staff as the Commanding Officer's secretary.

Dr. M. E. COHEN joined the staff as the Biomedical Statistician in the Dental Care Delivery Division.



Mr. J. TINDIRA receiving a NDRI plaque and a Letter of Appreciation from Captain M. R. Wirthlin upon his retirement.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,
AND REENLISTMENTS (Continued)

APRIL

Ms. M. J. ROUSE was promoted to GS-6 Editorial Assistant and Head, Office Services Branch in the Administrative Division.

Dr. L. G. SIMONSON and Dr. B. L. LAMBERTS received a patent application award.

Mr. K. KUETER resigned from the Veterinary Sciences Division.

Mr. J. RINGGOLD joined the staff in the Maintenance Branch of the Administrative Division.

MAY

DT1 W. V. REESE received a Bachelor of Science degree from Southern Illinois University, Carbondale, Illinois.

DT2 M. J. EDENFIELD was nominated NDRI's "Sailor of the Year."

Good Conduct Awards were presented to the following staff personnel:

HM1 E. LARSON
DT3 D. Portis

Ms. M. J. ROUSE received a Sustained Superior Performance Award.



DT2 M. J. EDENFIELD being presented with the letter nominating him as NDRI's "Sailor of the Year" by Captain M. R. Wirthlin.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,
AND REENLISTMENTS (Continued)

JUNE

CDR R. G. ESQUIRE, DC, USN joined the staff from the Naval Regional Dental Center, San Francisco, California.

CAPT E. B. HANCOCK, DC, USN detached for duty at the National Naval Dental Center, Bethesda, Maryland.

JULY

HM3 D. REIHER advanced to HM2.

DT3 T. P. MCCARTHY joined the staff from Clinical Laboratory School, San Antonio, Texas.

DN D. H. GAGNON joined the staff from the School of Dental Assisting and Technology, San Diego, California.

Mrs. C. ROSS joined the staff as an Animal Caretaker.

DT2 N. MINTEN was nominated as the NDRI "Federal Woman of the Year."

DT1 S. BOCKOWSKI joined the staff TAD from the Naval Regional Medical Center, Great Lakes, Illinois.

DT3 M. GOLDING detached to the Clinical Laboratory School, San Antonio, Texas.

A. SEROWSKI completed master's thesis "Fluorescence Immunoassay," at Northeastern Illinois University.

CAPT E. P. LEONARD detached for duty at the Naval Medical Research and Development Command, Bethesda, Maryland as the Oral and Dental Health Program Manager.

DT2 N. MINTEN was discharged from active duty.

LCDR D. SCHROEDER joined the staff from the Naval Regional Dental Center, Pearl Harbor, Hawaii.

CDR R. S. BAYCAR joined the staff from the 21st Dental Company, 1st Marine Brigade, FMF, Hawaii.

AUGUST

LT S. A. LEONE detached for duty at NAMRU-3, Cairo, Egypt.

DT1 W. F. BRUTON was discharged from active duty.

HONORS, AWARDS, POSITIONS HELD, CEREMONIES, STAFF ARRIVALS, DEPARTURES,
AND REENLISTMENTS (Continued)

AUGUST (Continued)

LT M. PORVAZNIK joined the staff from Armed Forces Radiobiology
Research Institute, Bethesda, MD.

E. PEDERSON received a 10-year pin and certificate for government
service.

Captain M. R. WIRTHLIN, DC, USN was the Reviewing Officer for Recruit
Training Command graduation.

SSGT A. J. HORTON advanced to TSGT.

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